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ARTICLE III.

On the Visceral Anatomy of the Python (Cuvier), described by Daudin as the Boa Reticulata. By J. P. Hopkinson, M.D. and J. Pancoast, M.D. Read before the American Philosophical Society November 2, 1832.

THE head having been previously removed, and with it, the commencement of the œsophagus, the account of that part of the animal will necessarily be wanting.

The whole alimentary canal admits of two divisions. The first, comprising the œsophagus and the stomach, extends as low down as the right capsula renalis, and is above five feet in length. The second division is two feet long, may be considered to represent the small and large intestines, and ends at the anus. These two divisions are connected by a smaller transverse canal, which is the pylorus. The œsophagus, at its commencement, is sufficiently capacious to admit both hands expanded. In structure, it is very thin, dilatable, semi-transparent, and, when left undistended, collapses by its elasticity. It passes down, at first on the middle line of the body, having the trachea closely attached to it in front: before reaching the heart it begins to incline to the left, and is then placed between the left lung and the parietes of the body. The structure gradually becomes more dense by the addition of delicate muscular fibres. A contraction is found just above the upper end of the liver, where it is embraced, in the flexuous course

of the left aorta, which seems to be the cardiac orifice, for below this point commence the gastric glands or follicles, some of which are of considerable size. The muscular fibres continue to increase in number, until a strong muscular coat is formed, consisting of fasciculi, which are circular within and longitudinal externally. The lower ten inches of the stomach are destitute of the large glands above alluded to. The mucous coat, at this part, is thrown into long rugæ, and the structure itself is very thick and cuts like cartilage. The stomach ends in a cul de sac, diminishing much in size as it terminates. At about half an inch distant from this termination, and passing off at a right angle, is the pyloric portion of the stomach, somewhat resembling that of the viper, as described by Sir E. Home. It is two inches in length, half an inch in diameter, and somewhat curved: the mucous coat of this part is thrown into longitudinal rugæ, and protected externally by strong muscular fibres, but the actual passage is very small. This pyloric portion terminates by joining the second division of the alimentary canal about half an inch below its commencement, projecting into it, to form a circular elevated margin; it is therefore placed transversely across the body, and forms a somewhat indirect communication between the two great divisions of the alimentary canal. In some of this class, a well marked pyloric valve is formed, constituted of an elevated fold of the mucous membrane. The second division, comprising both small and large intestines, is perfectly straight, and begins by a pointed cul de sac, similar to that which formed the termination of the stomach. From its commencement, the mucous coat is completely studded with villi, which are prominent and about a line in length. This intestine enlarges as it descends, and is embraced between the two reflexions of peritoneum, which attach the oviducts. Its greatest diameter is observed about ten inches above the anus, from which point it gradually diminishes as it descends, to accommodate itself to the smaller size of the body. The parietes are thick and firm, although not so much so as those of the stomach. Externally it is marked by several contractions extending the whole length, which produce deep transverse depressions without, and corresponding circular septa within; these septa, or valves as they may be termed, are very numerous, and extend generally around one half of the internal

circumference, resembling those in the colon of man. In three or four places, distinct and removed from each other, some remarkable and sudden diminutions exist in the calibre, scarcely large enough to admit the little finger, but which were not accompanied by any corresponding appearance externally. The channel here is oblique, as regards the course of the intestine, and extends for the space of half an inch, so that it is discovered with some difficulty. Such a conformation must very much retard the passage of the food, and in fact absolutely arrest it until perfectly digested; it also may afford the lacteals, by the consequent delay, full time to take up the chyle. In this way nature compensates for the want of a more extensive canal, the protraction of digestion supplying the defect arising from the limited surface of the canal. The lower fifth of this intestine is smooth and nearly destitute of villi, thus presenting the characters of the rectum. At the termination of the rectum, a sudden contraction is made to form the anus, a circular opening, which is placed immediately above the vaginal pouch, being nearer the ventral surface, and further removed from the caudal extremity. The anus is surrounded by some circular fibres, causing the mucous coat here to be puckered into small folds.

BILIARY ORGANS.

The liver is placed on the right side of the spine, and commences at the distance of about two feet and a half from the head; it is fifteen inches in length, oblong and somewhat flattened in shape, of a dark brown colour, and tapers to a point at either end. The peritoneum, which covers it and forms its external coat, attaches it along the back. The vena cava meets it below, and runs in a fossa along the whole length, and in the middle of its anterior or ventral face, leaving it at the top, to go to the right auricle of the heart; it lies beneath the peritoneum, which thus covers the anterior face of it. A multitude of branches is received by this vein from the liver throughout the whole of its course, causing it to augment in size. On the dorsal face of the liver, the vena portæ, coming from the stomach and intestines, is accommodated in a similar manner; but this vessel, in consequence of its distributing branches continually to the gland,

diminishes as it proceeds upwards, until finally it is completely disposed of, and terminates as it reaches the top of the liver. The structure of the organ in this instance was soft and rather of a pulpy consistence, perhaps the result of incipient putrefaction. From the lower end, passes off the hepatic duct, almost as large as a crow's quill, but becoming smaller as it descends; this diminution is owing to its giving off many smaller branches in its course, which leave it at acute angles, and then run for some distance parallel with the main duct. Some of them seem to disappear on the parietes of the vena cava; but from their minuteness, although a quicksilver injection was resorted to, their termination was not satisfactorily made out. The principal duct is about twelve inches in length. When it reaches the top of the gall bladder, it divides into several branches, which are spread over its outer surface; some of them open into the cavity of the gall bladder by small orifices, scarcely large enough to receive a fine bristle: four only of these openings were discovered, but probably others existed. The remaining branches, without communicating with the great receptacle of the bile, are collected into a fasciculus, and seem to terminate in a small depression or pit, found at the top of the intestine. The gall bladder is rather more than two inches long, and an inch and a half broad; it is of an egg-like form, having the larger end above, and a small, somewhat conical extremity directed towards the intestine,—it might contain about two ounces. The quantity of bile found did not exceed six drachms; it was of a dark colour, becoming orange when diluted, and slightly bitter to the taste. The apex of the gall bladder was connected to the top of the intestine by a ligamentous chord; but no communication was found to exist between them, and consequently no direct means ascertained by which the bile could escape from the gall bladder when once deposited there—in other words, for the cystic bile to get into the intestinal canal. This was ascertained by allowing the quicksilver to flow from the biliary tubes into the gall bladder, where it accumulated to distention, but found no exit.

PANCREAS.

This gland is small, and is attached to the pyloric portion near its termination, and to the upper end of the intestine at the cul de

sac. It is bent upon itself, forming a curve which embraces the cluster of biliary tubes, as they are about entering the intestine. The upper portion is enlarged into a head. The whole gland, when removed and stretched out, measured only two inches. The structure of the pancreas is lobular: the lobes vary in size from one line to three, are of a brownish colour and very numerous; they are connected merely by loose cellular membrane. The excretory tubes proceed from the lobules, run in company with the biliary ducts, and terminate at the same point in the intestine, already described.

SPLEENS.

In this animal there are two spleens, both of which are firmly attached to the parietes of the stomach: the larger, which is also lower down in its position, is three inches long, and an inch and a half broad; the smaller is two inches long and one broad; they are quite distinct, and about an inch apart. A cavity exists in each spleen, which, in the larger, might contain about half a drachm, from which numerous canals pass off in different directions towards the circumference. This cavity communicates with the stomach by a smooth orifice or channel, of the diameter of a crow's quill; a mass of hair, rolled into a ball, occupied the main cavity. The arteries of the spleens come from the gastric, while the veins open into the vena portæ.

URINARY ORGANS.

The kidneys are placed in the fossæ on the side of the spine, reposing upon the ribs. The right kidney is larger, and also placed higher up than the other; the upper end being about one foot nine inches below the liver, while the left is five inches lower. There are about two inches difference in their lengths, and nearly half an inch in their diameters, but in other respects they are precisely alike. The kidney is attached to the parietes by being embraced between the same two laminæ of peritoneum that pass off to surround the oviduct. It is of a dark brown colour, and consists of flattened oblong lobes, about thirty in number—some crescentic, others twisted like the letter S, and connected together by each lobe overlapping its successor. This arrangement commences at each end, and proceeds towards the centre, where

the two layers meet. About an inch distant from either extremity, it begins to taper off, and is then suddenly brought to a point. The ureter is placed on the external surface of the kidney; small, at its commencement, it descends along the middle line, increasing continually in its course, and when it leaves the gland has attained the size of a goose quill; from this point to its termination, it is rather more than fifteen inches in length. It opens into the vaginal pouch, by an oblique orifice, situated half an inch lower down than the opening of the oviduct. In immediate connection with the ureter are two veins, like it passing superficially along the whole length of the kidney. One of these, which lies in contact with the lower margin of the ureter, commences below, and increasing as it proceeds, from the continual accession of branches from the gland, passes off from the upper end, and soon after unites with the corresponding vein of the other side, to form the vena cava. The trunk, which lies above the ureter, is reversed in its course, commencing in the ovaria above the kidney, and increasing in size as it descends; it passes along the upper margin of the ureter, and continues to accompany it after it leaves the lower extremity of the kidney. This vein and the ureter pass down together, being connected by the same broad reflection of peritoneum that attaches the oviduct. The two descending veins of the kidneys, like those which ascended to form the vena cava, also unite; this junction, which takes place just below the orifice of the vagina, forms a single vein, that passes down to the caudal extremity. Both before and after the coalition of these two vessels, constant communications, by means of large trunks, are formed between them and the venous circulation on the side of the spine, in which manner it finally terminates. This vein, then, appears to be an insulated vessel; for it originates in small ramifications, in the ovaria, and lobes of the kidney, and seems to have no other destination than to join the great circulation of the spine. This peculiarity suggests the idea, that it is intended to obviate the injurious effects of an impeded circulation when the stomach is distended with food; a distention, from the habits of the animal, likely to be great and of long duration. Under such circumstances, these vessels may, by a circuitous route, carry a large proportion of blood to the heart, which the vena cava alone would be unable to accomplish in a state of partial com-

pression. The emulgent artery is connected with the kidney in the same manner, as were the veins and ureter; it is seen passing from the upper, to terminate at the lower extremity of the gland, being in contact with that vein which forms the origin of the vena cava. It is about a line in its greatest diameter, where it touches the top of the kidney. The capsulæ renales are two long narrow bodies, of a light yellow colour and speckled appearance, being situated above and near the kidneys, but not in contact with them. That on the right side is six inches long, and from one to two lines broad; it comes to a point at each end, and is about three-fourths of an inch distant from the kidney, to which it is connected by the peritoneum. The left capsule is one inch shorter than the other, and is situated lower in the body, but in other respects they resemble each other in all particulars. The capsules and the ovaria lie almost in contact, and are included in the same process of peritoneum.

ORGANS OF GENERATION.

The ovaria are rounded and somewhat flattened bodies of a yellowish colour, and filled with a muddy coloured albumen. They are numerous, and vary from one to six lines in diameter; they are all connected together and arranged in a row, which, on the right, is ten inches long, and on the left eight—the whole forming a curve, the convexity of which is outward on either side. The upper end of the row commences near the fimbriated extremity of the oviduct, which is here drawn in towards their commencement. The oviducts are two in number, and are arranged as follows: that on the right side is three feet three inches in length, the other eight inches shorter, but with this exception they are precisely alike. The oviduct, as it is found in an unimpregnated state, is flaccid and collapsed, being marked by minute transverse folds or wrinkles, which disappear upon distention. Inflation causes this tube to swell out, displaying a most beautiful transparent membrane of wonderful delicacy of structure; it then presents successive enlargements or ampullæ, two or three inches in extent, and contractions, extending an inch or more, interposed between them. The peritoneal attachment is at least four inches in breadth, and is so loose as to allow the oviduct to be spread out from

the body on each side; when thus stretched it forms a curve, the broadest part of which is about the middle. The lower portions of the two oviducts rapidly approach each other towards the caudal extremity, and passing on the ventral face of the rectum, proceed on each side of the anus to open by an oval orifice within the upper margin of the vaginal pouch. The upper portions of the oviducts form a curve, whose concavity looks towards the spine, and approach the upper end of the row of ovaria, without, however, touching them. Each upper orifice, or fimbriated extremity as it must be termed, is a free, very distensible opening, one inch in length, forming a sulcus inwards, which terminates in a point; from this point proceeds a well defined edge, two inches long when put on the stretch, formed of peritoneum, and acting as a ligament of attachment. The orifice of the oviduct, therefore, is removed considerably from the ovaria; with this arrangement it is not easy to explain, either, how the semen masculinum arrives at the ovaria, or how the products of impregnation can get into the oviduct. The vagina, common to the ureters and oviduct, is a pouch of a conoidal shape, three inches deep, and an inch and a half in diameter at the external opening, which is also larger and more exposed than the anus. It is placed between the termination of the rectum and the spine, filling up all the space between the ribs at this part. The orifices of the oviducts are oblique, a quarter of an inch in their long diameter, and are placed about an inch apart, within the upper edge of the vagina.

RESPIRATORY ORGANS.

The larynx consists of a single cartilage, having a narrow oblique slit in it, about six lines in length, for the transmission of air; the trachea is one foot eight inches in length, and three-eighths of an inch in diameter, and, as before remarked, passes down attached to the ventral face of the œsophagus. It consists of a great number of imperfect cartilaginous rings, interrupted posteriorly, but joined by an elastic substance which keeps their extremities in contact. Each ring is connected to the adjoining one by a membrane also elastic, so that when the trachea is stretched lengthwise, it will easily regain its former condition. It passes behind the heart, and while there concealed,

divides into two bronchiæ, appropriated to the two lungs. The lungs, in a collapsed state, lie much concealed, being covered in part by the liver; but, when inflated, are brought into view, and cause the liver to be raised up. These organs consist in two distinct vesicles or bags, united above along their middle, but terminating below, each in a separate cul de sac. They differ materially in size, but vary less in this respect than those of snakes in general. The right lung is two feet ten inches long, and about four inches broad, and extends down as far as the gall bladder; opposite the spleens, which are on its left, it has a considerable contraction of its diameter. The smaller vesicle lies on the left side, and is loose at its lower end; it is only one foot nine inches long, and three inches broad; it terminates near the lower extremity of the liver. The lower four-fifths of each lung are thin, semi-transparent, and supplied with fewer blood vessels than the upper portion. The parietes are marked by circular lines or striæ, along which are strung small white bodies, apparently vesicular, from half a line to two lines distant from each other; they are much more numerous above, and appear to be merely attached to the inner surface. The upper portion of each lung is composed of a more spongy structure; the parietes are much thicker, and present on their inner surface a loose reticulated texture, somewhat resembling a section of the corpus cavernosum penis, the cells, however, being much larger. A free passage is left through the centre, so that the air, in inspiration, is not obliged necessarily to pass through the cells, which seem to present merely a more extensive surface for the purposes of respiration. Both lungs contained many worms, found most abundant above among the cells, and even in the trachea; they were of various dimensions, being from one to three inches in length, whitish, cylindrical, tapering, and surrounded their whole length by elevated rings or cords.

CIRCULATION.

The heart is situated about two feet from the head, on the middle line of the body; it was flaccid, and contained some firm coagula; it was of an oblong form, and about four inches in length. The two auricles constitute the upper half, and are distinct, having their apices entirely separated above. The right auricle, which is rather smooth

internally, receives the blood from the two *venæ cavæ*. These great veins unite to form a sinus exterior to the auricle, and communicate with it by means of a single narrow opening or slit: this opening is both guarded and formed by two membranous valves, which, in a flaccid condition of the auricle, are loose and movable, but, when the auricle is dilated or stretched, are drawn together like the eyelids, and meeting in a straight line, thus interrupt the communication between the auricle and the sinus. From the right auricle the blood passes into the right ventricle, by an orifice which is small, and situated at the posterior part near the septum of the heart. Within the ventricle, and attached around that portion of the semi-circumference of this opening which is next the septum, a large and loose valve is observed, having in the centre of its floating edge a hard body like the *corpusculum Arantii* of the human aorta. This valve is placed obliquely as regards the ventricle, is very strong, and when pushed upwards towards the auricle, is found to close the communication with that cavity completely. In this condition of the valve, however, we see exposed on its lower side another orifice, which is that of a free but somewhat oblique passage, going through the septum and opening into the left ventricle. It follows, from the attachment of this valve immediately between these two openings, that in closing the one it exposes the other: that is to say, when it is thrown down so as to allow the blood to descend from the right auricle into the right ventricle, it is placed against the passage leading into the left ventricle, in such a manner as to prevent its entrance into that cavity; on the other hand, when it is elevated, and placed against the opening leading into the right auricle, it leaves free and exposed that which communicates with the left ventricle. The cavity of the right ventricle is marked by some pits or depressions, which are more abundant near the apex, and make its internal surface very irregular. Upon the posterior inferior face of this ventricle, commencing near the apex, and going up to terminate at the roots of the great vessels arising from this cavity, is a fleshy column, attached along one edge to the ventricle, while the other is free; it increases in breadth as it ascends, and forms a partial septum, dividing as it were the ventricle into two cavities. At the point of termination of this column arise three great arteries; two *aortæ* for the general

circulation, and one pulmonary artery which divides to supply the two lungs; they are so placed at their roots, as to form an arch by their lateral connection, and their relative situation is as follows. The left aorta, the smallest of these trunks, is placed in the middle between the other two, and is also the most anterior; it communicates with the ventricle, immediately beneath the fleshy column just described. The pulmonary artery is situated on the left of this vessel, and is much larger than either of the others; it opens into the ventricle, immediately in front of the fleshy column, which therefore intervenes between the orifices of these two vessels, causing the pulmonary artery to hold communication with the anterior cavity of the ventricle, as formed by the column, and the left aorta with the posterior. Immediately behind the root of the left aorta, and much concealed by it, is the orifice of the right aorta,* which is therefore also beneath the column, and connected with the same division of this ventricle; it is intermediate in size to the other two. From this arrangement it follows, that the blood which is thrown out from the right ventricle is divided into two columns, one passing out by the pulmonary artery in front of the fleshy column, and the other by the two aortæ below it. Each of these great vessels is furnished at its root with two semilunar valves, which are calculated to close the orifice of communication with the ventricle, having also two sinuses of Valsalva (as we must term them) to be filled with blood, in a retrograde movement of that fluid. The mechanism, in fact, excepting only in the number of the valves, is like that of the great arteries of the human heart.

The coronary arteries, two in number, arise from the left aorta, and are distributed upon the substance of the heart; the coronary vein, which returns the blood from these arteries, opens into the right auricle. The passage before alluded to, connecting the two ventricles, opens below the fleshy column, near the two aortæ, and, consequently, in direct communication with those vessels. Now, as the blood that is thrown out from the left ventricle, passes directly by that passage into the upper corner of the right ventricle, it is brought at once to

* The terms *right* and *left*, as applied to the aortæ, are meant to indicate the side of the spine along which the artery passes in its descent to the point of junction.

the mouths of the left and right aortæ, which therefore convey pure blood that has passed through the pulmonary circulation. But the pulmonary artery, which is shut out from any communication with the left ventricle by its origin in front of the column, conveys only that blood which was in the anterior portion of the right ventricle, and derived from the right auricle. The left auricle is about one half the size of the right; the septum between the two auricles is membranous and perfect, so that no communication exists between them. One large pulmonary vein opens into this auricle, conveying the blood from both lungs. Below is the opening that leads into the left ventricle; this ventricle is many times thicker than the right, and appears to have less than a third the capacity. At the upper, posterior corner, and in the septum ventriculorum, is the orifice of that passage already described, as establishing a communication between the two ventricles. Between this orifice and that of the left auricle is a large and loose valve, so attached as to close them alternately, as it may be elevated or depressed precisely upon the same principle as explained in reference to the valve of the right ventricle. When this valve is elevated, therefore, it exposes the only outlet belonging to the left ventricle, namely, that passage through the septum which conveys the blood into the right ventricle at the roots of the two aortæ. The right and left aortæ unite at an acute angle behind the lungs, and on a level with the top of the liver, the left having first passed around the œsophagus. The artery that supplies the neck and head is a branch of the right aorta, and comes off from it about two inches from the heart.

VEINS.

The venous circulation is complicated, and consists of four divisions.

1. The vena cava inferior is constituted of branches coming from the kidneys, ovaria, oviducts and liver, being connected with the latter organ, as it passes up to the heart, where it unites with the cava superior, bringing the blood from the head and upper parts of the body.
2. The vena portæ commences in the intestine, spleens and stomach, by branches which, uniting, form a trunk that passes to the liver, and is distributed throughout its structure.
3. Another distinct trunk is

formed of branches also commencing in the kidneys, which descends, and, as already explained, terminates in the spinal circulation. 4. On each side of the spine, between the anterior faces of the transverse processes and the sides of the bodies of the vertebræ, passes the vertebral vein already alluded to, which receives the intercostals in its course, and also communicates with the interior circulation of the spinal canal. The ultimate termination and particular forms of these vertebral veins or sinuses, were not satisfactorily made out; it was merely ascertained by a mercurial injection that they ran the whole length of the spine, and formed frequent communications with the vena cava as well as with other veins. A pipe having been fixed in one of the veins of the inferior portion of the body, the quicksilver run out freely from the spinal canal at the cut extremity of the neck, from which the head had been removed; thus, to avoid any particular local congestion, it would seem probable that, through the medium of the double circulation of the kidney, aided by the vertebral veins, the several divisions of the venous system are made to hold free communication.

With much regret was it that we found ourselves obliged to suspend the investigation here. We hope, however, to be enabled at some future time to resume the study of the structure of so interesting an animal, under more favourable auspices, and to do it more justice.

Explanation of the Plate.

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| A. The Œsophagus. | 1. Hepatic Duct. |
| B. The Stomach. | 2. Gall Bladder. |
| C. The Pylorus. | 3. Renal Capsules. |
| D. The Intestinal Canal. | 4. Ureters. |
| E. The Anus. | 5. Orifices of Ureters. |
| F. The Vaginal Pouch. | 6. Orifices of Oviducts. |
| G. The Liver. | 7. 7. Vena Cava. |
| H. H. The Oviducts. | 8. 8. Vena Portæ. |
| I. The Spleens. | 9. 9. Veins descending from Kidneys to |
| K. The Pancreas. | Caudal Extremity. |
| L. L. The Ovaria. | 10. Pulmonary Vein. |
| M. M. The Kidneys. | |
| N. N. The Lungs. | |
| O. The Trachea. | |
| P. The Pulmonary Artery. | |
| Q. The Left Aorta. | |
| R. The Right Aorta. | |
| S. The Common Trunk formed by junction of two Aortæ. | |

Fig. 2 is merely a duplicate of the caudal extremity, or lower portion of Fig. 1 ; and will be understood by a reference to the same letters in the explanation.



